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MORE ABOUT THE NEW TILLAGE PRACTICES

SOIL CONSERVATION

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E. H. Reed contributes a thoughtful article to this issue, urging the importance of the human factors in farm planning for conservation. "The needs and adaptabilities of the farmer must be considered, as well as the needs and adaptabilities of the land," he points out. The farmer's first object is to make a good living.

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WELLINGTON BRINK
EDITOR

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CONSIDER THE FARMER AS WELL AS THE FARM

By E. H. REED [1]

"Farms should be planned according to the needs and adaptabilities of the land"—this statement has been made and repeated so many times that it has become commonplace to members of the Soil Conservation Service. From its inception, the Service has stressed the physical characteristics of the land in formulating programs for areas or plans for individual farms. With the development and use of land-use capability classes, a further attempt has been made to enable farmers as well as technicians to obtain a more clear-cut picture of the physical conditions and capabilities of the land and their importance in farm conservation plans. Consideration of the "needs and adaptabilities" of the land is, and always will be, essential in farm planning.

In too many instances, agricultural economists, of which group I am a member, have paid little or no attention to the physical capabilities of the land. A few days ago a bulletin on farm planning, written in 1941 by an agricultural economist, came to my attention. In this bulletin, size of business, combination of enterprises and productivity of enterprises were the chief factors considered. No mention was made of the physical conditions of the land as a factor in planning; nor was anything said about maintaining the productive capacity of the land—the chief capital resource. To use the vernacular, "My brethren, these things ought not so to be."

There is no doubt in my mind that physical characteristics of the land should be given more, rather than less, consideration in farm planning. But, certainly, physical factors are not the only factors—the needs and adaptabilities of the farmer must be considered as well as the needs and adaptabilities of the land. The farmer's chief objective in farming is not soil conservation. He is farming to make a living. To obtain the largest possible continuous income, he must utilize all his resources to the best advantage. It is the farm planner's job to assist the farmer in formulating a plan that will afford the most efficient continuous use of his resources. His resources include, in addition to the land, his labor, his managerial ability, and his operating capital. All these must be taken into account in farm planning. In many instances, inadequate attention to these factors has resulted in plans which were not economically feasible and could not be put into effect for this reason. Farm conservation plans should be both physically effective and economically feasible.

Just as "there is more than one way to skin a cat," there is more than one system by which the productive capacity of a particular piece of land can be maintained. We might keep the land in cultivation with a short rotation and intensive conservation practices such as terracing and strip cropping; we might keep it in a rotation consisting of one year of a small grain and 4 years of hay, with simple practices such as contour cultivation or strip-cropping; or we might keep it in improved pasture. The alternative to be selected depends on the needs and adaptabilities of the farmer as well as the needs and adaptabilities of the land.

Some farm planners speak of "ideal" land use when what they are referring to is the most intensive cultivation the land can sustain while its productivity is maintained. The most intensive cultivation to which a given piece of land may safely be subjected is not necessarily the "ideal" use for it. Let us assume, for example, that all the land in a dairy farm consists of capability-classes I and II. From the capability standpoint, all of this land could be farmed in a 3-year rotation with simple conservation practices. Since this is a dairy farm, however, probably the "ideal" use for half of the acreage is properly managed permanent pasture. The needs of the farmer as well as the needs of the land must be considered.

Labor, managerial ability, and operating capital frequently are as important in determining land use as are the physical capabilities of the land. Recently I helped to plan a farm that contained

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40 acres of class III and class IV land which was idle, in addition to 80 acres in pasture, permanent hay and woods. The owner wanted a conservation plan for the farm and wanted to utilize this idle land. He was living on the farm, had two cows, some hogs and chickens, and a garden, but no machinery or work stock. He had a full-time job off the farm from which he would retire in 15 years. We discussed with the owner three alternatives for the use of this idle land, namely: (1) Rotation crops with a diversion ditch and strip cropping, (2) improved pasture, and (3) woods. After a full discussion of the advantages, disadvantages, and net income possibilities of each alternative, it was decided that this idle land should be planted to trees—this because for 15 years the operator will have but little labor to put on the farm, he has no equipment, and he does not want to supervise hired help. About half of the area is to be planted to locust so that after harvest of the first crop of posts it can be devoted to pasture if desired. The remainder is to be planted to trees to be utilized for pulpwood.

Had this been a full-time farm with labor, machinery, and equipment available, the class III land probably would have been devoted to rotation crops and the class IV land to pasture or meadow. In other words, the plan as formulated was suited to the needs of the land and the farmer. Were the farm to be acquired tomorrow by an operator who had labor, machinery and operating capital, and who must obtain his entire immediate income from the farm, the plan would not be suited to his needs. The farm would have to be replanned to include more intensive use of the land so that he could utilize his labor, machinery and operating capital and thus produce a larger immediate income.

The farmer's own personal plans for his farm business also must be taken into account. I recall one farm with a field next to the road which, from the physical standpoint, was admirably suited for strip cropping. The farm planner suggested that this field be kept in cultivation and strip cropped, but the farmer explained that he wanted this field in improved bluegrass pasture to serve as a "show window" for his pure-bred dairy herd. Since the farmer particularly desired to advertise his dairy herd, pasture was no doubt the best use for this field.

Another field on the same farm was well suited to terracing, and the farm planner wished to terrace this field and keep it in a rotation of corn, small grain, and 2 years of hay. This would have been entirely satisfactory from the standpoint of conservation. The terraces were suggested by the farm planner partly because he wanted a demonstration of terracing in the community. The farmer, however, had been using alfalfa silage on another farm, and he preferred to use alfalfa rather than corn for silage on this farm. As he was part owner of a feed store, he could purchase concentrates at wholesale. Furthermore, the growing of corn would necessitate his hiring additional labor. Obviously, he did not want to grow corn, either for silage or grain. He wanted a rotation consisting of small grain, 3 years of alfalfa-grass hay, and 3 years of pasture. With this rotation, terraces were unnecessary and if installed would have been a demonstration of what not to do.

In this instance the farmer's experience with alfalfa silage, his ability to purchase concentrates at wholesale, and his shortage of farm labor were major factors in determining the rotation. Had this farm been owned by an operator who was unwilling to use alfalfa silage, who could not purchase concentrates at wholesale, who had adequate labor, and who did not especially desire to advertise his dairy herd, the use of strip cropping on the one field and terracing on the other with a 4-year rotation probably would have been the best alternative.

In farm planning, we should consider with the farmer all alternatives that will achieve conservation, and after a discussion of the advantages and disadvantages of each of these alternatives, select the one mutually agreed upon as best for the particular situation. In too many instances only one alternative is suggested. If this does not accord with the farmer's needs or wishes, a compromise is made which many times results in a physically ineffective plan. Usually, were other alternatives considered, one could be found that would be both physically effective and economically achievable.

Often, when questions are raised about a

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SOIL CONSERVATION

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TILLAGE AND CROP RESIDUE MANAGEMENT

By L. S. CARTER [1]

One type of large duckfoot or sweep subsurface cultivator.

FOR many years the prevailing tillage and crop residue management practices for the grain-growing lands of the Great Plains, the western intermountain areas, and the Pacific Coast have consisted of covering all crop residues as completely as possible during initial tillage operations, and then cultivating intensively for weed control and the development of a seedbed. Where a summer fallow system was followed, the stubble and straw, and other organic materials, were considered liabilities rather than assets in that they interfered with development of the loose, well-pulverized soil condition desired during the fallow period and for seeding operations. In many instances farmers believed that a seedbed of clean, well-pulverized soil was essential for seeding and a satisfactory stand of grain, and for this reason they burned or otherwise destroyed crop residues to prevent their interfering with tillage operations.

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Seeding stubble mulch fallow with a deep-furrow drill.

This type of crop residue management, along with the intensive tillage practiced in the principal grain-growing areas of the West, has greatly depleted the soils of their ability to absorb water during periods of relatively high rainfall, to retard run-off, and to resist the forces of wind and water erosion. Intensive or excessive tillage produces a single-grain or pulverized structural condition of the surface soil. Such a condition tends to reduce or retard the rate and extent of water intake—soils become compacted or puddled

during rainfall periods and hard or crusty when dry, so that the amount of surface run-off is increased and the final result is erosion by water. Furthermore, a finely divided or single-grain structural arrangement of soil particles facilitates the pick-up and transportation of soil material by wind, with the result that serious soil loss from cultivated land is suffered in areas having wind erosion problems.

Experiments and experiences of farmers during the past few years have brought to light the tremendous value of a rough, trashy soil surface condition for protection of the land against wind and water erosion. It has been found that a rough, cloddy surface, covered with straw or other organic materials, absorbs water at a much greater rate than a smooth well-pulverized surface. By this means run-off is retarded, moisture evaporation is reduced and the soil is protected against blowing.

During recent months numerous efforts of farmers, manufacturers, and others have been directed toward the development or adaptation of tillage implements and methods that will provide the desired mulching of soil surface under grain-farming conditions. In general, most of these efforts have been aimed at modification of existing equipment and the refinement of tillage implements. Some special types have been developed to meet particular conditions encountered in handling large quantities of residues, or to demonstrate fundamental principles before recommendations are made for general use. The development and use of straw spreaders for combines has increased tremendously since it was found that large quantities of straw, if properly spread, can be handled as mulch if stubble mulching implements are used in the tillage operations.

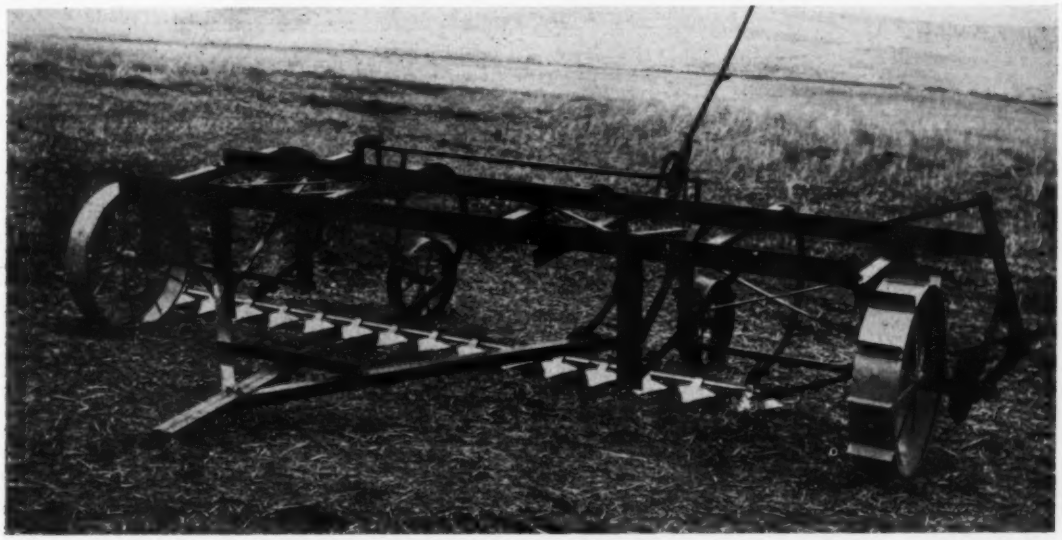
The condition of the land following initial tillage operations and during the fallow period will vary in different parts of the country, depending on the desired condition. In some sections a smooth surface, with all or most of the residues remaining on the surface and stubble in an upright position, is desired. Under other conditions a rough stubble mulch is believed to give the greatest protection against wind and water erosion. In the Pacific Northwest it has been found that a rough cloddy condition of the surface gives considerable protection, and in the development of tillage practices efforts are directed toward producing such a condition. Modifications of tillage implements are being made, to produce clods and bring them to the surface while all residues are left on top. It is believed that in the Great Plains and particularly where wind erosion is a problem, a smooth surface with most of the stubble in an upright position will tend to reduce the blow hazard and also will facilitate collection and holding of snow. On sloping lands all these operations, whether designed to produce a smooth surface or a rough cloddy one, should be conducted on or as near the contour as is possible. Thus, in any attempts to modify existing equipment or develop new implements for tillage and residue management, the desired condition of the surface soil following tillage operations should be borne in mind.

In developing a stubble mulch system of grain farming through the use of crop residues and tillage, consideration must be given to the cropping system followed, the amount of residues available for mulching purposes, and the types of tillage implements being used by the farmer. Where a system of cropping and summer fallowing is practiced, the time of starting the tillage operations, and the number of operations required to destroy weeds and to condition the land for seeding, will vary from those employed under an annual cropping system. The amount of crop residues available for stubble mulching will depend on the methods used in harvesting the grain crop, the time of starting the initial tillage—whether fall or spring—and the amount of rainfall. The type of equipment being used by farmers will influence the number of operations required. Thus, since the farmers are familiar with them, initial attempts to inaugurate a stubble-mulching system of tillage should deal with modifications or improvement of these implements.

The ordinary moldboard plow may be converted to a very satisfactory stubble mulch tillage implement by removing the moldboard. Elimination of the moldboard results in an implement which lifts and breaks the soil instead of turning it over. Not only is most of the crop residue left on the surface by a moldboardless plow but, if the soil is dry, clods are formed and brought to the surface so that a rough stubble-mulched condition is produced. For plows of the quickly detachable share type, a narrow strap of steel is required in place of the moldboard as a support for the share and to protect that portion of the soft metal frog to which the moldboard was attached. Since this metal strap gives some turning capacity, the roughness of the plowed land and the amount of residues left on the surface can be controlled to some extent by its width when it is used to replace the moldboard. Removal of part of the moldboard will have a very similar effect on the operation of the plow.

Of considerable interest to farmers is the reduction in power required to pull a moldboardless or a modified moldboard plow, compared to that of the conventional type. Dynamometer tests have shown this reduction to be from one-fourth to one-third that of the ordinary

Condition of land after moldboard plowing and rod weeding.



Attachment for rod weeder to enable penetration of compact fallow, or to be used for initial tillage on light soils.

plow. This reduction in power, converted into cost of tillage operations, may be quite significant where large acreages are plowed and large power units are used.

A weeding operation should follow the initial tillage with a moldboardless plow, to keep down soil moisture losses through transpiration by weeds, to firm the seedbed under the mulch, to establish a subsurface moisture zone and to condition the mulched surface for absorption of water during the next rainy period. The ordinary rod weeder is one of the most effective and inexpensively operated weeders for working summer fallow land, after modified moldboard plowing. This implement, operating below the surface, severs weed roots, compacts the lower portion of the plowed zone, works clods and trash to the surface and mellows the seedbed. Land that has had a sufficient number of rod weedings to meet the purpose of weeding, seldom requires any further preparation for seeding.

Seeding of grain on stubble mulched land may require some care on the part of the operator in getting the seed placed below the rough, mulched surface. It is most important that the grain be placed in the finely tilled, compacted, moist, subsurface soil zone to secure proper germination and stand. While the deep-furrow and the ordinary disk type of drill is most effective for drilling grain through a stubble mulch, almost any

Field cultivated with straight-blade cultivator. Volunteer rye 8 inches high at time of cultivation. Moisture conditions excellent 5 inches below surface.

drill can be used if the mulch is relatively light. For extra heavy mulches or a very rough, cloddy condition, some modification of the ordinary drill, or the use of a deep-furrow type, is necessary to do a good job of seeding. Numerous studies and observations have shown that satisfactory stands of grain can be obtained on seedbeds with a much rougher, mulched condition than was thought possible a few years back. Care should be taken to leave the surface in an undisturbed condition as much as possible during drilling, so that the young grain seedling will have some protection while becoming established. The clods and mulch on the surface after drilling are of great value in slowing down run-off while the grain is becoming established.

One of the most extensively used implements for initial tillage of stubble land, particularly in the relatively low rainfall area, is the one-way disk. This widely distributed machine is known by various trade names such as the disk tiller, wheatland plow, one-way, etc. The amount of mulch left on the surface during one-way disking is determined by the quantity of straw and stubble on the land, the size and curvature of the disks, the dryness of the soil, and the speed of operation. High speeds and moist soil result in extensive coverage of crop residues and unnecessary pulverization of the surface layer. One-way disking of heavy textured, dry soils, produces the very rough, cloddy condition which is the desired goal of initial tillage for some areas. Fall disking of extra heavy stubble, to promote some decomposition of the residues and prepare the land for summer fallow tillage, is done quite extensively in the higher-rainfall areas of the Pacific Northwest. For moderate to light quantities of residues, spring disking is preferred over fall disking, since these light residues offer more erosion protection during winter in an upright undisked position. Fall disking is objectionable because the stubble decays and the quantity of mulching material for protection of the fallow land is reduced.

A number of straight-blade tillers or cultivators have been developed for use in grain stubble, particularly in those areas where wind erosion is a serious problem. These blades operate under the surface, sever weed roots, loosen the soil to a depth of 3 to 6 inches and leave the stubble in an upright position. The operation of a straight blade leaves a smooth surface, so desirable under some conditions, with all residues on the surface for mulching purposes. The depth of cutting can be regulated to meet the need according to different soil, climatic, and weed conditions. One example of the straight-blade type of cultivators, known as the Noble blade, was developed by a farmer and used very extensively on his farms in western Canada. This and other similar blades have been used without other implements for tillage of stubble and for the control of morning-glory. In those areas where a rough, cloddy surface condition is desired, the Noble blade is not as satisfactory as some of the other subsurface tillage implements. Trials with this and other types of straight-blade implements are now under way in all principal grain-growing areas of the West.

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HUMPTULIPS AND WHITE SALMON

By H. H. BENNETT
Chief, Soil Conservation Service

WE left Bozeman by rail at twenty after nine in the morning and arrived at Spokane at twenty after nine the evening of the same day. Most of the journey—some 470 miles—was across the Rocky Mountains.

The Rocky Mountains at this latitude merely conform in size with the bigness of the country in general in this part of the world. It has seemed to me that from a commanding view anywhere near Billings, Mont., as from the Big Horns, you see the biggest country on the continent. There are no such far horizons in the Andes, or in the lofty ranges of Alaska. Mexico looks diminutive from her towering peaks, as compared with our northern Great Plains, particularly the Wyoming-Montana sector.

You don't see much farming through the Rockies after leaving the Bozeman Basin near the forks of the Gallatin, Madison, and Jefferson Rivers; it is chiefly grazing country, forests, and burned-over forests, with occasional fields of alfalfa, grass, and small grain along stream bottoms.

We were off to the Palouse next day, by way of the hill section lying between the Palouse proper and the mountains on the east. This mixed prairie and timbered area is even more broken than the Palouse and has much shallow soil, fragile like sugar and very erodible. One field is recorded as having lost 137 tons of soil per acre in 1940.

Doc Clanton's place near Rockford was so severely washed that, it was reported, he had quit farming about 1935 and was ready to quit paying taxes. The farm must have been badly "whipped" with gullying and sheet washing; we could still see the effects as we walked over it in September 1941.

Between 1935 and the present this place—the entire farm—has gone through a renovating process of soil conservation. The steeper, gullied slopes have been seeded to grass-legume

Pasturing 193 acres of sweetclover and grass seeded in the Palouse. Seedings of this nature are valuable as a soil builder, in controlling erosion, and as pasture. During one fall season 2,500 head of sheep pastured here and in the following spring 400 head of cattle grazed the same field.

mixtures and wheat has been worked into rotations with soil-holding, soil-building crops—legumes and legume-grass mixtures. Trees have been planted along the crests of high points to catch and spread snow—to protect critical slopes from accumulations of deep drifts and consequent severe localized erosion. Original acreage yields of 45 bushels of wheat had dropped to 8 or 10 bushels before installation of the conservation practices. But in 1941 the yield went back up to 40 bushels an acre.

We drove from the Latah-Rock Creek Soil Conservation District, on through the Pine Creek District and into the North Palouse District. Along the way we saw much plowing of wheat stubble without burning; we saw only one or two very small burnings of stubble on this 200-mile trip through the Palouse region. Farmers were plowing under wheat stubble, or plowing part under and leaving part on top as a protective cover (though not quite enough in some fields). In places sweetclover also was being turned under, to enrich the soil and improve its tilth. But what stood out over everything else—you saw then in any direction you chose to look on the entire trip—were the steep-slope plantings of sweetclover and grass-legume mixtures—generally alfalfa seeded with one or more of the various adaptable grasses.

Cut-over, burned-over Pacific Northwest forest producing some grazing but not many trees. This land is capable of more productive use through the right combination of grazing and tree management.

Here I saw that profound changes were taking place on the land—a revolution in land use, soil protection, and soil building. Some weeks previously I had seen another such change toward sound land use and conservation—in the old red hills of the South Carolina Piedmont country. I described that too as a revolution on the land; and here in the Northwest, as in the Southeast, the revolution was paying dividends in increased yields and increased income.

You see I had visited this Northwest country before and had a handy yardstick for computing progress. My first visit was in 1927—gathering ground information in connection with a reconnaissance survey of soil erosion in the United States (not the 1934-35 erosion survey but the preceding one).

At that time there was a very little, if any, interest in soil erosion. One section we examined in some detail was the country between Pullman and Walla

Patterns of conservation are invading the wheatlands of the Pacific Northwest.

Walla. Here we found (1) an abundance of sheet washing on summer-fallowed land, (2) nothing being done to stop erosion or slow it down—except in a single field—although much was being done to accelerate the process, and (3) around 80 to 90 percent of the what stubble being burned.

Then in 1930 I came back, looking for a suitable sight for an experiment station to study the problems of soil erosion and soil and water conservation. Cooperating with members of the staff of Washington State College, we scouted the countryside again. This time we found items 1, 2, and 3 as above, unchanged, and discovered an additional situation—some people didn't even know the meaning of the word "erosion."

We had invited ourselves, by phone, to talk to the county commissioners after their night session at Colfax. When we went in, the chairman asked if we were the people who wanted to be heard about "something or other."

"Yes," I told him, "we understood it would be agreeable to talk with you gentlemen a little while about what we think is a matter of great local importance."

"Oh, sure; we'll be through with this county business in a moment, and then glad to hear anything you want to tell us."

"We want to talk about soil erosion and the possibility of establishing an experiment station for studying the problem."

"Well," said the chairman, "I don't know what erosion is, but in a moment you can just go ahead and tell us all about it, whatever it is."

I undertook to explain the local and national erosion situation and made the plea that before it was too late we should look into the problem of conserving rich Palouse soil. When I was through, one of the big wheat growers present said,"You know, I have a lot of that stuff on my place, and it's not getting any better. Something's got to be done about it."

Well, we helped get the desired support and the station was established. Since then many folks throughout the region have learned about erosion. Not only that, they have done a lot about it on the land—conservation work, I mean.

Later, the erosion control demonstrations helped to arouse interest in and support for the movement; and now soil conservation districts are getting off to a splendid start through the Pacific Northwest. At the

time of this last visit there were 12 districts in Washington State, comprising more than 2 million acres of farm and ranch lands, orchards, woodlots, and logged-off lands.

Instead of the nearly universal burning of wheat stubble, most farmers now utilize the stubble to hold topsoil and rainfall. Instead of growing practically no soil-improving crops and being afraid to plow under green-manuring crops, growing and turning under sweetclover is rapidly coming to be an everyday farm practice. Instead of the common assertion I heard during my first trips to the Inland Empire—"But this is a wheat country! We don't know what to do with hay crops or grazing crops—there are no animals to consume such products,"—instead of this I saw livestock grazing on both grass and legumes. I also saw haystacks and learned that the animal industry aspect of the farm business is up and coming. Also, sheep and cattle on the way to and from high summer ranges in Idaho are held longer here in the Palouse for the excellent grazing that doesn't hurt the land and does help the farmer—by way of a new source of income.

On this trip I saw for the first time in my life a farm field of big bluegrass (*Poa ampla*). It was on a Palouse farm near Moscow, Idaho, and was successfully grown in combination with alfalfa. It had been cut for seed, making a satisfactory yield.

This is one of a group of grasses brought into the nursery at Pullman by Service technicians for testing as to suitability for controlling erosion or fitting into vegetative combinations that in any way provide direct or indirect benefit to eroding lands. Big bluegrass, along with a number of other native grasses, such as western wheatgrass, little bluestem, big bluestem, blue grama, and sideoat grama, was never previously cultured on a field scale—so I have been informed. They, and others, have been brought into commercial use through the endeavors of the various nursery testing stations of the Soil Conservation Service. The collection and sale of seed of these promising new grasses—new in the sense of domestic use—is gradually developing new enterprises for seedsmen and farmers.

Next day we joined a group of land technicians, irrigation specialists, economists, railroad people, and others for a look at the area within which irrigation farming is to be established on the more suitable lands as soon as water is available from the great water-conservation and power project at Grand Coulee.

The party had an excellent opportunity to see the general lay of the land and the effects of erosion as the result of recent rains on summer fallow, and to study some of the principal types of land and their agricultural capabilities at the three sites selected for this purpose—flat land with deep soil, rolling land with deep soil, and flat to undulating land with shallow soil.

From Ephrata we set out early next morning for the Trans-Cascades via the Moses Coulee and Douglas County Soil Conservation Districts and Stevens Pass. We spent some time on the 12,000-acre tract covered by the Billingsley-Maxwell-Carter-Meyer cooperative agreement with Moses Coulee District, beginning in Sage Brush Flats and extending down into the Coulee itself. Under this joint agreement the four men pooled their ownerships and lease rights in order to carry out a mutually beneficial system of fencing out trespass stock and dividing their range into five pastures to facilitate deferred and rotation grazing. Springs were developed for watering places. The size of the pastures and herds was based on topography, range capacity as determined by survey, and availability of water. A number of cattle trails were built so that the animals could graze both the Coulee lowlands and the plateaus high above.

One of the ranchers told me that this four-way agreement was paying dividends, particularly by reason of better cattle and increased length of the range grazing period.

Bob Billingsley, one of the parties to the four-ply ranch agreement, lives way down at the foot of the basalt bluff, on the east side of Moses Coulee. It's a beautiful situation—worthy of a story in itself. Rich coulee-bottom soil, flat, cozily situated—and much like one of those places you like to dream about for retirement purposes. There are cherries, apricots, melon fields, a garden of highly diversified contents, alfalfa fields—and finally, water arranged for the convenience of all.

None too much rain here, but floodwaters come down the Coulee from dryland farming areas and ranches somewhere upstream (up-Coulee, rather). This water, with the aid of dykes and ditches, Billingsley spreads over the alfalfa and other plantings to produce excellent crops.

Not only is the floodwater used to high advantage; the run-off from a stock spring, developed up-country under the conservation program, is directed on to a small turbine that provides electricity for the farm.

We lunched with the supervisors of the Douglas Soil Conservation District at Waterville. I had noticed some severe erosion on sloping land in that vicinity, the result of recent rains on fallow fields where most of the wheat stubble had been rather completely

turned over and covered—"black fallow." Wherever a good mulch of stubble had been left on the surface, little or no erosion was observable. I called attention to this, and one of the local wheat growers explained that use of larger disks was one cause of recent deterioration in the effectiveness of stubble-mulch farming as practiced in this locality. It seems that recently a good many wheat growers have changed from disks of 22-inch diameter to 26-inch diameter, and that these larger disks cover the stubble more thoroughly than those of smaller diameter.

Later in the afternoon we reached the 408,000-acre Snohomish Soil Conservation District, near Everett, where, at present, control of streambank erosion, pasture and woodland improvement and management, and drainage work are among the principal activities.

On the way over, we were a bit saddened, while passing through the apple country, at the sight of so many uprooted apple trees. In places entire orchards had been pulled out. This was the result of an accumulation of untoward economic conditions that have been plaguing the apple industry for a number of years. Orchards that could not ride the tide of low prices any longer were giving way to other crops of greater promise. Some of the uprooted trees were of the finer varieties, others were of inferior quality.

We spent some time next day interviewing a number of farmers who have been assisted by Service foresters working with the CCC camp and operating through a Washington Forest Products Association functioning as a local cooperative. On some of the farms we found that one of the chief problems was timber management. Around 50 percent or more of many of the farms is occupied by second-growth timber, mainly Douglas fir and mixtures of cedar, white fir, and alder. It is said that during the first season, 1940, more than $15,000 worth of forest products were marketed by the local members—not so much, but still it is $15,000 they were not getting before. The Association had 69 members, and between 35 and 40 participated in the cutting.

I asked Jasper Storm, near Sultan, if he had been helped by the Service foresters. "Yes," he replied. "Without the SCS help, we could get little or nothing for our timber. Contacts and sales are made for the members of the co-op that individuals couldn't make for themselves. The buyers wouldn't be interested in the small amounts we have to sell individually. But they are interested when we throw in together through the co-op. Besides that, I have a conservation plan now for the management of my woodlands and for the establishment of a pasture."

What has been accomplished on this tract—accomplished with astonishing rapidity—makes a powerful story of the practical possibilities of economically utilizing natural resources in accordance with sound principles of conservation. Here was a tract of 360 acres, most of it covered with second-growth. The owner was getting very little from it, aside from firewood and a little pulpwood. It was necessary to get outside employment for a living. It was difficult to meet payments due on the purchase price.

Without going into details, a conservation plan for management of the woodland problems on a portion of the tract and the development of 12 acres for pasture was prepared; and then an agreement was entered into in October 1940, for execution of the plan.

The financial returns from 80 acres of woodland, to June 1, 1941, were reported as amounting to $1,940, or $24.25 an acre. It was pointed out that the net return to the owner on a stumpage income of $8 an acre would amount to $640. Actually the farmer did the bulk of the work himself and so got pretty much the whole $1,940.

The amazing result of this first year of conservation operation is that all Storm's debts were wiped off, his taxes paid, and he purchased 160 additional acres of second-growth land. Thus, in less than 12 months, what looked like a hopeless situation has been turned into a profitable enterprise, promising security for the future.

People often ask us, Is conservation practical? Fellows like Jasper Storm are our evidence that not only is conservation practical, but that few farmers can afford to do without it.

Another member of the co-op, Dan Barker, a logger, bought a tract consisting of 100 acres of farm land and 120 acres of what he called "brush." It was reported that when his neighbors used to come in and ask for wood, Barker would say: "Sure, take what you want; there it is." Then a conservation technician worked out a complete farm plan for him and induced him to join the co-op—though somewhat reluctantly.

I was told that as a result of what was done, the co-op in 1940 paid him $280, stumpage, for the poles and piling alone on 40 acres of the 120 acres of so-called "brush" land—where the neighbors had been helping themselves to firewood, etc.

Among various interesting conservation practices on the Barker place—pasture improvement, woodland improvement, etc.—I ran into a planting of flat peas (*Lathyrus Sylvestris*) that seemed to be getting a good start in a very heavy stand of fern. On another farm flat peas appeared to be on the point of taking the ferns

for a ride. At any rate they were wrapping themselves about the unwanted plants much after the manner of the South American tree killer, *mata palo*. If this native perennial pea does work out according to present indications, we shall have something of momentous value—an eradicator for one of the bad weed pests of the Pacific Northwest coast country.

In the Montesano-Elma-Oakville Soil Conservation District of Grays Harbor County, we had the opportunity of carefully examining streambank erosion control work along several streams, as well as other phases of district conservation work.

This District is near the wettest part of the United States—the Olympic Mountains. At Wynooche Oxbow, 9 miles north of the district boundary, 43 inches of precipitation fell during the first 21 days of December 1933 and an annual total of 184.56 inches was recorded in 1931. Nevertheless, droughts occur here at times and are conducive to forest fires and crop damage.

Six large rivers flow through the district—the Chehalis, Satsop, Wynoochee, Wiskah, Humptulips, and Quinalt. Floods appear to have been accelerated since extensive logging operations pushed back deeper into the headwaters. The record high was recorded on the Chehalis in 1937. Run-off records show that on the Wynoochee the agricultural and cutover (completely deforested) portions of the watershed have a higher per acre run-off during the peak months of flow than the mainly forested upper watershed, in spite of the much heavier rainfall over the latter type of country.

The alluvial lands of this region are highly productive and support many farmers. They are perfectly suited to the extensive dairying industry of the locality and also to highly specialized farming, such as the production of garden seed.

The first farm inspected was the W. J. Wharton tract on the Satsop, where across the river we saw the worthless gravel-bar remains of what once was an 80-acre farm of rich Chehalis silt loam, ruined permanently by stream-bank erosion. To keep the Satsop where it belongs Wharton has dumped along his eroding banks many loads of debris, consisting of anything from old cars to bedsprings. He has also stretched a wire cable near the base of the undercutting bank for collecting river debris. Along the line of the cable, piles of driftwood have accumulated and a gravel bar is now building up which, thus far, has effectively protected the bank. Later we saw similar effective control work on the Wynoochee. In other words, man here has cooperated with nature in a way that has caused the destructive force of stream currents to turn to the business of building up a protective barrier against its own land-destroying depredations.

Some people quibble about spending money on river control, usually those who look at productive land in terms of real estate deals. They profess to think that when an acre of productive soil is lost, we have lost just its value as real estate, which in this instance may be $150 or $200 an acre.

But the way we soil conservationists look at it is that we have lost the basis of an entire community. It isn't what Wharton and his neighbors have lost. That is bad enough, of course. It is what all of us have lost, this year and next year, this decade and the next. The 80-acre gravel waste across from the Wharton place may never produce again. Certainly it won't for perhaps hundreds of years. And so, the permanent loss of 80 acres of land having a productive value of say $150 an acre per decade would amount in 100 years to a monetary loss of $120,000—if one might be permitted to figure it this way.

Up on the Wynoochee, at John Zak's place, the job of bank control necessitated the cutting of a straight channel through a gravel bar in order to bring stream flow under orderly behavior. The technicians have skillfully located the new channel so that its upper end contacts a straight reach of river instead of a curved section such as would have permitted cutting of the banks of the new channel to start immediately.

Here the rampaging stream not only was cutting out some of the most productive land to be found anywhere, but the buildings were threatened and also a steel bridge. The cutting of the 1,700-foot channel involved the moving of 30,000 cubic yards of gravel. The job was completed the day before we arrived.

From the Zak farm we drove out into the logged-off and burned-over uplands, where there was a splendid bird's-eye view of a vast area of stumps, fern, brush growth, and pervading silence, with here and there islands of young conifers. Here is good soil, much of it—thousands of acres, lying idle, land capable of producing rapid-growing trees, excellent grasses and grass-legume pastures; and undoubtedly capable also of supporting many families, under the right kind of farm-forestry system. I have seen such land standing idle in Oregon, land that was denuded of forest by a fire that occurred some 80 years ago—good land still producing worthless brush and nothing more.

Probably something can be done to get the better of these lands back into productive use. On one farm—the M. C. James farm in the Snohomish Soil Conservation District—I saw such stump land put back into

Leaving part of the wheat stubble on the surface effectively protects the land from erosion.

use by seeding red clover and timothy between the stumps after the best logs had been recovered from the waste of the original lumbering operations and the useless material burned. The notion some people have that logged-off land can't be used for agricultural purposes until the stumps are pulled did not hold on this tract. Grass and legumes are being grown, and livestock is doing the harvesting.

While discussing the possibilities of salvaging firewood, cedar logs, and other usable wood from the waste of the original logging operations, Mr. James spoke of farmers who buy coal for fuel. Could you imagine that—with firewood scattered all over the ground, thousands of acres where firewood is in the way!

We could not very well overlook Puget Island Soil Conservation District. It is just one-tenth the size of a ranch I had visited only a few days previously in Montana—a 50,000-acre ranch. Even so, even if this is the smallest soil conservation district in the United States, it is still a very important one as well as a highly interesting one.

Conservation of the productivity of the land by means of rotations and the growing of legumes to improve the soil, and betterment of drainage conditions are among the more important problems being dealt with on this heavily populated island in the lower Columbia. Progress is being made with the district work and there is talk of expansion to take in part of the mainland.

By way of interest, we saw here in this smallest of all soil conservation districts the smallest farm I recall ever having seen in this country. And on this diminutive farm—with a total acreage of 1.1—a novel system of farm management was in use this year.

Peppermint is one of the important crops of Puget Island. This small-farm farmer is also a fisherman by profession, and during the season he goes fishing and actually gets paid for it. This year he put his entire farm of 1.1 acres in peppermint, bought three sheep and left them in complete charge of the outfit. When he came back from the business of the fisheries he found the sheep had dutifully eaten all weeds and grasses, but not one mint leaf. Most mint farmers weed their fields three or four times a year, but not this fishing-mint farmer. Besides, he made a better-than-average crop—72 pounds of peppermint oil, and the price was $3 a pound.

And now, up the Columbia—to the locality of the White Salmon. (You don't fish for 'em or eat 'em;

it is just a section of the country around where the White Salmon River enters the Columbia.) Here is the Underwood Soil Conservation District, located mostly in Klickitat County. Really pretty country. From the Columbia River gorge the road rises rapidly to high, dissected plateau country from which on a clear day the view sweeps magnificently across the Columbia, across Hood River Valley in Oregon, and on to the snowy summit of Mount Hood. Turn around and another lofty peak—Mount Adams—rises majestically above the world about.

The district started out with 14,000 acres, but was later increased by referendum to about 320,000 acres. A variety of problem areas are included, dependent primarily on physical condition of the land, accessibility, and climate. It was encouraging to find that the Service technicians aiding the district recognized these basic problems and were adjusting their thinking and planning to accord with the inescapable conditions imposed by nature.

One of the principal difficulties in the fruit section along the lower White Salmon has been clean tillage of orchards resulting in considerable erosion, especially on the steeper slopes. We saw one fairly large orchard that had been abandoned because of erosion.

Farmers are beginning to grow protective and soil-improving cover crops, to till their land on the contour, and to take cognizance of the capabilities of the land.

In the section east and south of Glenwood we saw an abandoned sawmill and a good many abandoned farm houses and fields on good red soil capable of producing good grass and grass-legume mixtures. Some of the farm houses seemed in good condition. Most of them were painted, but the yards about them and the fields were grown up to weeds. Evening shadows were gathering, the people were gone, there was silence—a ghost country, you might have called it, with ghost farms.

This country looked like other places I had seen, where people came in, took off the timber, and left without leaving very much in place of the natural wealth they had harvested and taken away. Then others came and opened up land for wheat farming. Wheat farming failed because this, almost certainly, is a grass-legume, livestock-timber country. Trees grow splendidly and there is considerable second-growth that could be brought into good forest condition with a little attention and protection from fire. Something could be done, no doubt, in growing hay for winter feed for the livestock of such localities as Glenwood, and probably also for locally raised livestock. At any rate, we saw one field with a mighty good stand of alfalfa.

The district, with the assistance of conservation specialists and the help of other agencies, has a promising opportunity, I believe, eventually to put the better parts of the present large area of idle land to work for the welfare of mankind.

From this point, near the end of the Oregon Trail, we turned our steps from the land of rushing rivers with their strange Indian names—from the Pacific Northwest—toward other parts of this great Nation.

REDUCING HIGHWAY MAINTENANCE COSTS THROUGH FARMLAND CONSERVATION

(Continued from back cover)

important matter has resulted in water entering and leaving highways to the detriment of all concerned—entering from farmland above and discharging over other farmland below. Many highways, roadbanks, and highway ditches are affected by consequent gullying and flooding, while soil and debris deposit on lower farms. Most of the rainfall on the highway surface runs off rapidly, and farmlands and highways alike are at the mercy of land-users occupying the slopes above. This situation is particularly acute in many of the glaciated sections of the Northeastern Region.

Before treatment of highway banks near Bennington, Wyoming County, N. Y.

The past 6 years, however, with cooperation between landowners and highway officials encouraged by the Soil Conservation Service have proved that the two groups can prepare a joint plan of water control to the advantage of both. The private landowner may be the first to receive protection by the application of a soil conservation plan for his farm, but the highway below the farm is benefited soon after.

Financial savings to the township of Cohocton, in Steuben County, western New York, are typical of the values of soil conservation to highways: Conservation measures have been adopted on 155 acres of farmland constituting the entire drainage area above three-fourths of a mile of gravel highway. Two-thirds of the drainage area has slopes ranging from 5 to 15 percent. About one-fourth is represented by slopes of 15 to 25 percent. Practically all of the soil is well drained.

This highway was closed to traffic three times during the summer of 1938 when erosion debris clogged road ditches and culverts. Power machinery and a considerable amount of hand labor were necessary each time to clear the debris from the highway in order to make it passable. Most of the highway damage was caused by surface water from two farms adjoining the road—the farms of G. M. Rynders and Fay Jackson. In the fall of 1938 the two farms comprising the drainage area were planned for erosion control. Land use within that area was replanned as follows:

	Before planning	After planning
	Acres	*Acres*
Cropland (including permanent hay, homesteads, highways)	129	118. 5 (5. 5 not treated)
Pasture	26	28.
Plantation	0	8. 5

Photographs 1 and 2 show the Rynders farm in 1938 and 1939, viewed from the Jackson farm.

Eight thousand feet of diversion terraces were completed in the fall of 1938. The waters from them were discharged in woodland or on pastures. Reforestation plantings were finished in the spring of 1939. Forty percent of the cropland treatment (contour tillage, contour strip cropping, and establishment of permanent hay) was completed during 1939, and by 1940 ninety-five percent of the new practices were established. No changes were made in the highway location or in original culverts. The Soil Conservation Service assisted in the construction of the diversion terraces and reforestation. It is estimated that the total cost in cash to landowners, had the construction and planting been done on a contract basis, would have been about $375.

Records from Soil Conservation Service rain gauges one-half mile from these farms showed that the duration and intensity of some of the heavier summer rains were similar before and after the soil conservation measures were adopted on the farmland.

The following maintenance costs (exclusive of snow removal) on this three-fourths of a mile of gravel highway were furnished by the Cohocton town superintendent of highways, George F. Ross:

Year	Labor	Machinery	Total
1935	$153. 35	$123. 00	$276. 35
1936	102. 30	87. 75	190. 05
1937	72. 25	40. 25	112. 50
1938	137. 40	110. 75	248. 15
1939	15. 00	3. 00	18. 00
1940	14. 75	3. 00	17. 75

Mr. Ross made this statement: "The sharp break in maintenance costs between 1938 and 1939 speaks for itself. The saving can be either passed on to the taxpayer in the form of reduced taxes or used for more permanent improvements elsewhere. Now that the soil conservation districts law in New York legalizes the use of town equipment on private land for erosion control, the money saved on highway maintenance might be used to further soil conservation and increase the permanent benefits to our town roads. Similar cost reductions on other highways in our township also are the result of farmland conservation. Where farmers have not taken steps toward conservation, the maintenance cost of highways has had a tendency to increase each year."

The same road, after backsloping and seeding of banks.

Highway bank protection, combined with farmland conservation, has given about equal public benefits. Roadbanks stabilized by bank sloping and revegetation prevent the silting of drainage ditches in summer and in winter make snow removal easier. The sloping and lowering of the highway banks allows much more room for the snow plowed from the highway.

Walter Kreutter, supervisor of Bennington township, Wyoming County, made the following remarks: "A highway demonstration project was recently completed by the Attica CCC Camp of the Soil Conservation Service. Formerly we worked at least 2 days each year with power shovel and two trucks, cutting back slides and filling washouts. These operations cost us about $100 yearly. Since completion of the demonstration, our total maintenance expense is about $3.50 yearly. This expenditure included one day's labor for mowing grass on seeded and sodded banks and ditches and a small amount of grass seed sown on some bare spots. The past year, we also saved at least $40 in snow removal. I believe that one great benefit from this roadside improvement work is the removal of traffic hazards. The educational value to the Town Highway Department also is highly important: it has demonstrated what can be done to improve highway safety and that roadside maintenance costs can be greatly reduced."

The highway to which Mr. Kreutter refers is only about one-half mile long. It receives excess water from 16 acres of cropland above. The soils are poorly drained and the slope is 10 percent. The 16 acres are now contour strip-cropped. Diversion ditches carry the water away from the highway and discharge on an improved pasture. Before the demonstration, the road banks were 5 to 30 feet high and nearly vertical. They were graded at a 1.5 to 1 slope and seeded. The road ditches were sodded. A highway culvert was lengthened and an outlet built for it. Now both private and public lands have a safe coordinated water-control system. Photographs 3 and 4 show one section of this highway. Before improvement the most serious damage occurred below the crest of the hill.

Attica township, also in Wyoming County, reports a saving during 1940 of $80 on eight-tenths of a mile of highway maintenance. This saving has resulted from soil conservation measures established during 1938-39 on farm land above the road and on the public right-of-way.

The highway banks cited above in Wyoming County were stabilized by a combination of sloping with sodding and seeding. Sites were always limed where necessary and heavily fertilized. Mulching invariably ensured the success of a seeding.

Limited experience with the use of shrubs indicates that they can be used satisfactorily for revegetating road banks. In Madison County, N. Y., several hundred feet were planted to low-growing shrubs with a spacing of 18″ x 18″. They included red osier dogwood, honeysuckle, gray-stemmed dogwood, Virginia creeper, barberry and bittersweet. A 95-percent survival was secured by a mulching of rye straw. Use of shrubs is limited by the availability of stock and the higher cost of planting. They may not give complete protection as quickly as sodding or seeding.

Whether shrubs are used or grass, the site preparation is vital to success. Sloping the road bank to the angle of repose is necessary. When this is not adequately done, partial failure of the revegetation is inevitable because sloughing will occur. Of equal importance is the interception of surface water from above. Farmland conservation will arrest most of that water. The balance may be diverted to woods or pasture land or safely discharged into an outlet, perhaps a highway ditch for which protection from erosion is established. In any event the installation of conservation practices for the entire drainage area is desirable for the most effective conservation of soil and disposal of surplus surface water.

These examples are illustrative of what wholehearted cooperation can accomplish. Townspeople and those interested in better roads should have a lively interest in soil conservation because the aggregate benefits of farmland conservation yield returns to others besides farmers.

LETTER FROM VICE PRESIDENT

Mr. Hugh Bennett, *Chief*
Soil Conservation Service

Dear Hugh: When I was in North Carolina last spring and in Colorado this summer, it seemed to me that I saw unusual evidence of the effectiveness of the work of the Soil Conservation Service and the Triple A. There were several years when it seemed to me as though the work were progressing very slowly, but now you can see the effects with your eye. This must be a great source of satisfaction to you.

Thanks for sending me the latest issue of your magazine "Soil Conservation." It is good to make people soil, grass, and tree conscious.

Sincerely yours,

(Signed) H. A. Wallace.

SINGING PLOWBOY PLOWS CROOKED TO WIN

By GLENNON LOYD [1]

BILL Moy, a Wisconsin dairy farmer on the Mississippi River bluffs near Mondovi, is quite a hand with either a guitar or a plow. He can sing and yodel too; but, best of all, he can "lap over" the neatest of furrows on the contour. He displays more than a little talent when he sits down to strum his guitar or to turn a furrow with his two-bottom plow.

Unexpected fame has swooped down on William S. Moy. He is now the "American Contour-Plowing King;" and the soil conservation districts of northeastern Iowa, southeastern Minnesota and western Wisconsin, where the Nation's first contour plowing match was promoted, have the satisfaction of knowing that they have excited new interest in soil saving.

Plowing matches are not new. Hundreds of them had been held in the Middle West before, but nearly always on level land. Straightness of furrow and even land ends were of primary importance on the judges' score card. The ideal created by the level-land matches traces back to the assumption that plowing "as straight as a crow flies" was just as important as keeping paint on the barn. In too many instances, a man's ability to plow straight determined whether or not he was considered a good farmer in his community.

Thus it is significant that in this new activity the districts have made another contribution to the tremendous task of getting people to use common sense instead of a mistaken notion when it comes to cropping sloping land.

Known as the "singing plowboy," Moy won his plowing title in the tri-state finals of the First Dairyland Contour Plowing Match last fall (October 8) near La Crosse, Wis. Two thousand spectators turned out for this new rural sports spectacle on the Lester Hoeth farm in Mormon Coulee which is recognized as the "cradle of strip cropping" in the United States.

Moy is forty-five, and the father of six children. He and the other five finalists in the tractor division had won elimination matches at Eau Claire, Alma, Viroqua, and Mount Horeb in Wisconsin, Lewiston in Minnesota, and Garnavillo, Iowa, where a total of 34 plowmen vied for honors.

The thirty-four plowmen, all "dirt farmers" residing within soil conservation districts, were chosen and sponsored by officials of the local districts. In a few instances, local contests were held to choose the district's representative for the elimination contests; but because time was short most of the districts nominated their entrants—they were assisted by the county agents, AAA county officials, and Service workers.

[1] Head, regional current information section, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

"A bit neater on his furrows," said the judges, and William S. Moy, the Mondovi, Wis., "singing cowboy," became the first contour-plowing champion in the United States.

The whole match—eliminations and finals—was set up and run off in 6 weeks. Attendance at the preliminaries and finals totaled 9,000, many more than anticipated in view of the fact that some of the eliminations were organized, promoted, and held in less than 3 weeks.

At the Mount Horeb contest, more than 3,000 spectators were on hand for the day's festivities. Side features included a contest for high-school agricultural students in laying out contour lines, demonstrations of pasture renovation, and the latest methods of hay harvesting. At Alma, one of the "extras" involved the construction of a broad-base terrace at the upper

edge of the contest field. At Eau Claire, a contest division for horse-drawn plows attracted a lot of attention. The horse plowmen jokingly declared that the land chosen for them was too difficult for the use of a tractor. At Garnavillo, Iowa, interest was heightened by a plowing match between the Mayors of Decorah and Elkader—neither had ever been on a tractor before.

Rain fell on the mornings of the Iowa and Minnesota events, and a 2-inch downpour 36 hours before the La Crosse finals left the match site spongy. The contestants agreed that the La Crosse field provided an adequate test of their mettle, aside from its sogginess; it had been field stripped previously, but the strips were not on the true contour. Thus the plowmen found part of their lands on sod and part on corn stubble, and there were plenty of natural drainageways to keep the men on their toes.

Trees on the upper slopes of the rugged hills in the Coulee were beginning to splurge their autumn hues, and the bright-colored tractors also added a touch of gaiety to the occasion. Moist furrows turned over by the two- and three-bottom plows glistened in the afternoon sun as the contestants skillfully drove their tractors back and forth across the hillside.

The 80-minute grind for the tractor plowmen followed a countywide horse-drawn contest in which four farmers, with reins over their backs, shuttled back and forth on a 20-rod stretch.

A small cannon's blast started the tractor contest. Rubber-tired tractor wheels spun, now and then, in the soft footing of the corn stubble, but the six experienced contour plowmen were not troubled. Showing their skill, and incidentally demonstrating the simplicity of contour plowing, they rounded out their opening furrows from one stake to the next. They yanked up their plows at natural drainageways and left the furrows jagged at grassed waterways and land ends. Five judges scampering up and down the slope, inspected the furrow slices and grassed waterways, and watched to see if a contestant failed to lap a furrow properly on a curve.

Age triumphed over youth in the end. Bill Moy, who got the judges' nod, was the oldest man in the contest. He won by a narrow margin over 19-year-old Halvor Brue of Hollandale, Wis., the youngest entrant. The land on both the Moy and Brue farms had been cropped on the contour for 6 years, so that neither was a stranger to this type of plowing. The Iowa representative, Albert Andera, Jr., of Calmar, placed third, and the Minnesota representative, Vincent Schafer of Lake City, was fourth. John Williams of River Falls, Wis., and Hilton Jordie of Onalaska in the same State also finished.

All the contestants showed the true sporting spirit. Moy, accompanying himself on his guitar, sang a tune to measure up to his reputation as the "singing plowboy." He told the crowd he was certain that his farm, where he had perfected his plowing technique, was the birthplace of the "sidehill gouger," the legendary beast that traveled around steep hillsides so much that its front and hind legs on the uphill side were shorter than those on the downhill side. Moy is a real booster for a complete soil conservation program, and the home folks are proud of him. They held a Plowman's Dance in his honor and followed up with a community testimonial banquet.

The supervisors of the La Crosse County Soil Conservation District sponsored the finals, and Chairman R. W. Davis raised $180 for cash prizes. The money was divided among the tractor contestants, the horse contestants, and the teams of high-school agricultural students who took part in a contest in laying out contour lines. Moy's prize was $30.

Tractor and farm implement companies gave all-out support to the new activity. Before the event their factory representatives tuned up motors and helped contestants make plow adjustments. Implement firms in the vicinity of the matches gladly provided equipment for the plowman who had to come too far to transport his own equipment. Local civic groups provided entertainment and prize money. Local Soil Conservation Service representatives assisted in selecting contest sites and staking out fields for the contestants.

The score card, which explained that contour plowing is "judged primarily for effectiveness and conserving water and soil," allowed 20 points for opening and closing furrows; 15 for adherence to the contour; 20 for waterways and land ends; 20 for conformation of furrows; 5 for trash coverage, including distribution of trash under furrow slice; and 20 for uniformity and evenness of width and depth.

Extension services and the soil conservation committees of the three States also lent a hand in promoting the matches. Judges at the finals were O. R. Zeasman, Wisconsin extension soil conservationist; Harold Hill, member of the Wisconsin AAA committee; and the three farmer members of the Wisconsin State Soil Conservation Committee, George Nygaard of Chaseburg, M. H. Ward of Mondovi, and Paul Weis of Madison.

What did the matches accomplish? That is not an easy question, but we do know positively that they stirred up a lot of healthy interest in the principles of soil-saving farming. Certainly they were timely and

Part of the 2,000 spectators at the first "crooked row" plowing match. They climbed the long slope and stationed themselves at vantage points. One of the contestants here rounds a curve.

appropriate—Secretary of Agriculture Wickard had warned that in the "food for freedom" drive farmers were going to guard against such depletion and destruction of soil as resulted from the ripping up of the hillsides in the first World War. The district office at Alma reported that after the match they noticed a sizeable increase in the number of farmers wanting their fields contoured.

Many of the districts already are making plans to promote county matches next year. Some have mentioned informally that they would like to serve as host at either the elimination or finals in 1942. Furthermore, sponsors of some of the straight furrow plowing matches have indicated they would like to add a "contour" class to their future contests. Tractor and implement companies naturally were interested because the matches gave some public recognition to the improvements and changes in design which they have made to facilitate plowing on the contour.

Last but not least was the wholesome publicity the matches gave the cause of soil conservation. They literally moved soil conservation news from the inside to page 1 of the local papers in that area of the three States. The contour plowing match—and soil conservation—became the subject of commendatory editorials in newspapers and state farm publications. A Nation-wide news photo service used a photograph of the winner. A member of the regional office staff discovered the "crooked furrow" winner's picture in the *Birmingham News*—Alabama. *Successful Farming* magazine had a photographer at the match, with instructions to cover the event for a two-page four-color spread. Nation-wide press services "trunked" stories of the match.

This event led to the making of a 1-minute movie trailer in which scenes of the plowing match and winner were tied in with the farmers' "food for freedom" drive for more meat, milk, and eggs. In late October, the movie short already had been booked in more than 130 theaters within and outside the contest area.

Ralph H. Musser, regional conservator, believes that the matches "will go a long way toward bringing about widespread recognition of the advantages and benefits that come from contour tillage."

"I expect to see a spread of interest in similar contests over a much broader area next season," he remarked. "This is in the direction along which all farmers should proceed, if our land is to be saved for future generations."

Nobody has a copyright on the contour plowing match idea; anyone wanting further information on the matches can get it by writing to Mr. Musser.

FLOODS IN THE NAVAJO COUNTRY

By L. L. HARROLD [1]

"A wall of water between 2 and 3 feet high . . ."

WATER in normally dry arroyos is an unusual sight in the arid Southwest. Even the natives are startled to witness in a dry channel the rapid approach of a black wall of water, sticks, stones, and other debris accompanied by a roar like that of a panzer division in distant battle. Tourists ask questions: "It didn't rain here—where did the water come from?" and "How did it concentrate so fast?" The answers are logical and interesting.

In the Navajo country, a few miles north of Gallup, N. Mex., rising 2,000 feet above the plains to an elevation of about 8,800 feet, Chusca Peak stands out majestically against the deep blue sky when not engulfed in storm clouds. This peak plays a part in the Navajo tribal rituals. It is on this peak and the surrounding plateaus and ridges that summer cloudbursts pour their water in large quantities. From these upland areas waters start their way down the steep slopes into deep canyons, picking up soil and foreign material along the way. Angrily, these waters pound against huge rocks and earthen sides of deep arroyos, seeking always the peacefully sloping channels of the plains, 2,000 feet below. It is no wonder that in crossing the dusty lower reaches of these streams, the traveler is astonished to see downstream a dry streambed and upstream a mad rush, literally a wall, of swiftly moving water and debris.

The accompanying photograph shows this phenomenon—a wall of water between 2 and 3 feet high, moving toward the photographer at a velocity of about 9 feet a second, or 6 miles an hour, or about twice as fast as the ordinary walking speed. The front of the wave is a moving dam of sand, sticks, stones, and trash pushed ahead by the water behind.

In steeper canyons the wall of water moves with higher velocity, and stones the size of an automobile are rolled along with a sound like the rumble of thunder.

As the flood wave passes out of the steep canyons into the arroyos of the plains and as each flowing tributary contributes its small debris dam to that of the trunk stream, its front becomes a moving dam of debris containing little water, but comprised mostly of trashy material, churning over and over. Behind these moving dams, in the arroyos of this Navajo country, the debris load carried in suspension by the flowing water at times is as high as 30 percent of the volume.

The scarcity of water in the arid Southwest makes conservation of water a vital part of agricultural planning for this region. In the headwaters of the large drainage basins where stream flow is intermittent and irrigation from subsurface waters is too costly, the silt-laden flood waters are spread over large areas of range land. Within recent years several problems have arisen concerning this practice: What are the immediate and long-term effects of the diverted arroyo waters and their accompanying sediments on native vegetation and soil? How do crops of corn, beans and oats, and the range itself, respond to irrigation by silty water? Research to determine answers to these questions is being conducted at the Navajo Soil and Water Conservation Experiment Station at Mexican Springs, N. Mex. Preliminary results, some of which are presented below, have been released in a progress report of this station for the years 1934–39 in publication SCS–ESR–9, dated March 1941.

The soils in the upper portion of the flood plains, for a distance of about 0.6 mile, became lighter in texture as a result of the increase in sand fraction. Soil moisture in the flooded areas reached 16 percent, or twice that in the untreated areas. Vegetal growth showed a marked increase in the flooded area where little sediment accumulated, whereas heavy deposits had the effect of decreasing the perennial vegetation. It was observed that galleta and western wheatgrass came up through a 7-inch blanket of silt within a single year; and in places western wheat, over a period of 4 years, came through 30 inches of silt and increased in doing so. Under small silt blankets, galleta increases greatly.

During 1938, 18 inches of silty flood water, and in 1939, 36 inches, were spread on 0.01-acre plots where

[1] The author is hydraulic engineer, hydrologic division, Soil Conservation Service. The article is based on data furnished by D. S. Hubbell, project supervisor, and T. E. Utterback, assistant hydraulic engineer, Navajo Experiment Station, N. Mex.

crops were being grown. The silt deposited on these plots averaged 185 and 353 tons per acre in 1938 and 1939, respectively. Corn yields for 1938 were as follows: irrigated with silty water, 34.4 bushels per acre; watered by precipitation only, 15.5 bushels. For 1939, silty water 57.8 bushels, and precipitation only 2.9 bushels per acre. Oat yields for 1938 were 5,200 pounds of forage and 48.7 bushels of grain per acre for silty water, and 850 pounds of forage and 7.2 bushels of grain per acre for precipitation only. In 1939 the oats did not mature because of lack of moisture at the time of planting and considerable time thereafter.

The progress report referred to contains additional interesting data on soil type changes; chemical, physical and bacterial changes in plots of similar soil texture; ground water fluctuations; and detailed summaries of rainfall, run-off and soil loss, and soil moisture from several watersheds.

TILLAGE AND CROP RESIDUE MANAGEMENT

(*Continued from p. 158*)

The widely used duckfoot cultivator lends itself to certain modifications that provide very satisfactory stubble mulch tillage. By making the duckfoot shovels larger and longer, tillage can be accomplished with a minimum of surface disturbance, but the blades must be operated parallel to the surface to prevent a furrowing effect. If the frames are built higher and the standards placed farther apart, and if wide blades or sweeps are attached in place of the duckfoot shovels, an ordinary cultivator can be made that will operate under a heavy grain and weed stubble. When properly assembled and operated this implement destroys weeds, leaves the stubble in an upright condition for collecting and holding snow, loosens the soil underneath, and promotes the development of a mulched surface. Subsequent tillage to destroy new weed growth, firm the seedbed, and keep the surface in a condition for water absorption is most important.

One of the latest and most promising developments along tillage lines is the shovel bar attachment for rod weeders. This tool consists of a heavy bar to which is attached a series of small shovels with the rotating square rod placed between the shovels and the bar. Flanges are provided to attach this assembly to the frame of the weeder and the rotating rod to the drive shaft. This attachment enables the weeder to penetrate relatively hard ground such as is encountered in initial tillage or compacted fallow. The implement is especially adapted to initial tillage of stubble on light-textured soils, and for weeding where summer fallows become compacted by summer showers. By going over stubble immediately after harvest, to kill weeds and loosen the soil, mulching can be accomplished with this implement at a much lower cost than for any other type of subsurface tiller. After the initial tillage to loosen the soil 3 to 5 inches deep, the shovel bar attachment can be removed. An ordinary rod can then be attached for weeding during the remainder of the fallow period.

CONSIDER THE FARMER AS WELL AS THE FARM

(*Continued from p. 154*)

physically ineffective plan, the reply is, "That is the economics of it. The farmer could not make the desired changes so we planned it this way." This is an indication of lack of economics. In the first place, a plan that permits unnecessary destruction of the land is not economically feasible. In second place, consideration of other alternatives which would not interfere with the farm income and would utilize the farmer's labor, managerial ability and operating capital to maximum advantage, probably would lead to a plan both physically effective and economically feasible. Here again the situation on the particular farm must be taken into account. If the farm is large in proportion to available labor and the farmer can utilize roughage, probably all the land of capability class IV and much of class III might be devoted to hay or pasture. On the other hand, if the farm is small, or land is high in price and labor is available, much of the class IV land might logically be kept in cultivation with intensive practices, even to the extent of bench terraces on high-priced fruit or vegetable land. No infallible rule-of-thumb can be used in determining the "best" use for a given piece of land. But, in my opinion, we should revise our statement of planning to read thus: *Farms should be planned in accordance with the needs and adaptabilities of the land and the needs and adaptabilities of the farmer.*

COOPERATION IN FIRE FIGHTING

By A. E. McCLYMONDS[1]

ONE day last summer a workman finished cleaning out a spring in the Flat Creek Valley, 16 miles south of Terry, Mont. He stood up, rolled and lit a cigarette, dropped the match and went about his business.

This was in mid-forenoon. Shortly after noon, the town of Terry received a call for help. The rancher and his helpers could not cope with the fire started by the carelessly dropped match. Flames already had burned over 2,500 to 3,000 acres and were spreading rapidly. Within an hour a hundred men from Terry, with equipment, were at the fire. An hour later it had been extinguished.

Undoubtedly men would have turned out as willingly anywhere else, because serious prairie fires have been the bane of the great open ranges of the West since their settlement. But those men from Terry were organized, prepared for quick action.

The Soil Conservation Service is vitally interested in this fire-fighting organization because all of Prairie County is included in a Federal land-utilization project. Furthermore, with 19 land-utilization projects embracing 24 million acres in the Northern Great Plains Region, fire control is a matter of major concern. An excellent feature about this organization is that it came into being solely on the initiative of the townspeople, although now the Soil Conservation Service plans to make some specialized equipment available to it. I believe the Service can well afford to spend some time organizing manpower for emergencies, such as fires the ranchers cannot handle. Without doubt this kind of work ties in closely with National Defense and with the objectives of soil conservation districts at all times.

It is true that for some years ranchers have been well organized, in the older projects particularly—caches of fire tools are to be found at strategic places and for the most part there has been little difficulty in handling fires. The Terry organization is interesting, however, in that it systematizes the help of townspeople, for emergency beyond the town's limits. They are ready when they are needed.

George Brubaker, cashier of the Terry bank and acting fire chief, explained it as quoted in the following: "The fire-fighting organization we have in Terry has grown out of experience. This country has had prairie fire problems ever since it was settled, and some of the fires have been extremely serious affairs. Ranchers are too widely separated to cope with bad fires, so they must be in a position to turn to a place where men are available quickly. In this county, Terry is that place. Formerly we had no organization of the manpower."

The present set-up was formed in 1938 through the efforts of the commercial club and the county agent at Terry.

"It is easy to get such a thing started, although of course someone must take the lead," Brubaker continued. "Now, every merchant has available a car and one man, for call at all times. Each car is equipped with a shovel, a bucket and wet sacks, and the county has provided a truck to carry barrels of water. Calls for help are made through the telephone exchange. If it is a general alarm, the telephone operator notifies all cooperators; if otherwise, the calls are rotated so that no one firm bears the brunt of the burden."

Each car provides transportation for five men. One of the five is a leader because, it is explained, when a call is received other men must be recruited from any place or places where they may be congregated.

"Our organization is designed to get help to ranchers expeditiously in cases of emergency, where they cannot handle the fire themselves, and nowadays they lose no time in making use of it," Brubaker remarked. "We are not called for all fires by any means, as the ranchers can handle most of them unassisted. But when we are needed, we are needed badly and confusion must be avoided. Actually, we have been called out only seven or eight times a year to stop fires that undoubtedly would have burned over large areas had we not been able to provide plenty of help without delay."

Behind this spirit of cooperation is a full realization by the townspeople of the relationship between their prosperity and the well-being of the ranchers, Brubaker pointed out. "We can't make a living here unless the farmer is prosperous. The ranchers are dependent upon the range grasses for feed for their stock, and in turn the town is dependent upon the agriculture of the county. True, there is some irrigation in Prairie County and there will be a little more, but it has been my observation elsewhere that irrigation alone is not the answer. Irrigated crop farming coupled with livestock farming seems to be best for this country."

The spirit at Terry probably is not different from that in any other town in the range areas, but the

(*Continued on p. 175*)

[1] Regional conservator, Northern Great Plains Region, Soil Conservation Service, Lincoln, Nebr.

Suggestions for Pasture Mixtures to Meet Varying Conditions

III

Q. I want to establish a soil-conserving, profitable pasture in the Southeast. What type of mixture shall I use?

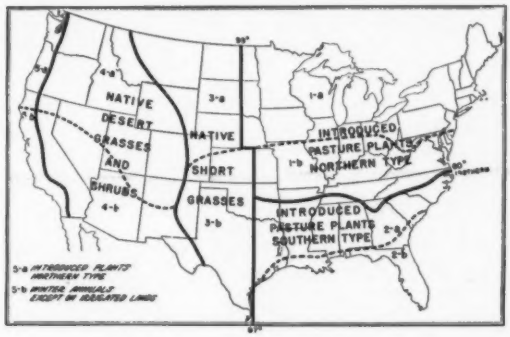
SOUTHEASTERN STATES (sections 2–*a* and 2–*b* of the map)
Mixture for moist, sandy soils:

	Pounds per acre
Carpet grass	5 or 6
Dallis grass	3 or 4
Lespedeza	12 or 15
Total	20 or 25

Mixture for clay, loam, or clay or silt loam soils:

Bermuda grass	5 or 6
Dallis grass	3 or 4
Lespedeza	10 or 12
White clover	2 or 3
Total	20 or 25

Common, Kobe, and Tennessee 76 lespedezas are the varieties to use in this region. Bermuda grass is



usually started by planting pieces of sod rather than seed.

For *short ley pastures* in the Southeastern States, a mixture of small grain and lespedeza is recommended. The small grain furnishes late fall, winter and spring grazing; the lespedeza provides summer and early fall grazing.

MONEY VALUE OF WOODLAND

Studies and surveys have shown that the properly managed farm woods can be made to produce a yearly net or periodic income to farmers comparable to that secured from other crops grown in the Ohio Valley. When the soil value and productive capacity as well as other factors are taken into consideration over a period of years, the income from the managed farm woods may even exceed that secured from other common crops.

From 1911 to 1939, a 33-acre farm woodland in northeastern Ohio produced an average net income per acre of $9.24. This undoubtedly includes the labor income.

A southern Indiana farm woods, for which records are available from 1807, produced an average net cash income of $5.60 per acre per year.

Higher records are shown for special products: $20 per acre per year where part of it was from maple syrup; $22 per acre per year for 36 years from a black locust plantation in Ohio.—LeRoy Frontz.

COOPERATION IN FIRE FIGHTING

(*Continued from p. 174*)

people here have gone forward energetically with real accomplishments in the matter of organization. When fires break out Prairie County can call on a group of experienced men, ready to move on a moment's notice and capable of leadership.

Twenty-three hundred bushels of wheat, which has served its purpose in experimental storage by the Grain Storage Investigation section of the Bureau of Agricultural Engineering and Chemistry, has been transferred to the North Dakota unit of the Soil Conservation Service for use in winter feeding of game birds when that becomes necessary.

Many cooperators are learning that they can get as much cash from their woodlands by making a light cut and selling each stick for the purpose for which it is most valuable as they can by selling the entire stand in bulk.—H. C. Mitchell, regional forester, Western Gulf Region.

BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neall Faris

FARM SOILS, THEIR MANAGEMENT AND FERTILIZATION. 3rd edition. By Edmund L. Worthen. New York and London. 1941.

This text now covers quite thoroughly the soil-management problems the farmer encounters in the field each season of the year. It is a practical book, thoroughly usable by anyone connected with the farming business, whether tilling his own soil, helping to plan other peoples' farms, or preparing to teach in a school of agriculture. The book is revealing also when considered from the standpoint of the value of agricultural research: It is through such well-organized and accurate presentations that research findings are translated into working material. Evidently Professor Worthen of Cornell, himself a scientist, knows that research is valueless unless or until results are made available to the people.

The arrangement of "Farm Soils" is excellent in that it is particularly adapted to every day use. Chapters are divided into two separate parts, the first, "operations" and the second, "general information." It works like this: In the chapter on growing the crop, for example, the first part tells what the crop needs to make it thrive and produce and how to go about supplying those needs; the second part tells why—why fertilizers, why air and water, why different soils for different crops. All kinds of crops are treated throughout, so that the volume as a whole has much of interest for the highly specialized grower as well as for the general farmer.

One rather long section of the book entitled "Controlling the Water Supply of the Soil" includes valuable recommendations for laying out and installing drainage systems—every step of the procedure is pointed out and carefully described with permanent and efficient farm drainage as the objective. Irrigation farming, dry-land farming, and soil-erosion control are treated in this same section in somewhat generalized fashion, but since most of the soil-conservation practices now widely used in this country are included in other chapters it cannot be said that these subjects are neglected.

Very useful are those parts of the book that explain the use and benefits of legumes, and pasture management under varying conditions. The farmer who has in his farm library such books as "Farm Soils" will not need to take the hit-or-miss course in these important phases of land use—in this volume he is not only told what to do and when, but why he should choose one method instead of its alternative, and what rewards he can expect for his trouble.

A large part of Professor Worthen's book—some 150 pages—is devoted to an exceedingly detailed treatment of soil-fertility improvement materials. The user of the book is provided with directions for determining whether or not various crops need manure, lime, and the commercial fertilizers in single or mixture applications. Here as elsewhere the author gives the reasons for recommendations, and backs them up with experimental results from some of the top-notch experimental institutions in the country.

For purposes of the classroom, apparently, Professor Worthen has included at the end of each chapter a set of "community studies" and a set of "problems." The student is advised to "Visit, where available, a farm on which erosion-control practices have been established. List the methods used and note their relative effectiveness." He is then asked to "Outline arrangement of crops for strip cropping where the rotation consists of two years of corn, one of oats, and three of hay." This is but an example—and these community studies and problems are far too extensive to be reviewed at length. They should be pointed out, however, as an important feature of this text, not only for the student but also for the farmer who is seeking better methods of soil management and a clearer understanding of the true effects upon soils of soil improvement practices.

The more specialized subjects are treated in chapters on management of garden, greenhouse, lawn and orchard soils. The book contains hundreds of classified references and is illustrated throughout.

THE SOILS THAT SUPPORT US. By Charles E. Kellogg. New York, 1941.

Introductions to scientific subjects usually make interesting reading, and this is no exception. For purposes of easy reading, apparently, Dr. Kellogg has omitted footnotes, credit lines and names of institutions and agencies responsible for the tremendous amount of research that today points toward more complete understanding of the soil of the earth and its relation to man. This makes the volume more or less a one-man book; and, certainly, the author knows his subject, writes with a pleasant and sympathetic style, and chooses carefully his phrasing so as not to discourage his reader in the approach to a most difficult and complicated science.

The book is designed, no doubt, for supplementary reading in schools. In simple language it explains the origin of soil and points out reasons for the wide variety of soil types over the earth's surface. Although "The Soils That Support Us" puts no great emphasis on conservation of soils as an urgent necessity at this phase and stage of man's existence, nevertheless throughout the book certain conservation methods and practices are described and explained as they have evolved from days of primitive farming to present modern land use for support of huge populations. As to the philosophy behind the reasons for soil studies and the conservation program in the United States, one chapter, entitled "Soil and Our Future," presents a rather wavering thought trend that were it expressed more definitely and vigorously might reverse the whole thesis of the book. It must be remembered, however, that Dr. Kellogg is essentially a soil scientist, whose aim is to locate, analyze and classify soils, rather than to protect and conserve soil resources for future generations to use.

Today, most young students, and students not so young, when beginning seriously the study of soil science, have in mind some practical application of knowledge after it is acquired. This book will serve the student well as an over-all picture, simply drawn, of what is involved in a necessary fundamental soil knowledge, and it will do this without allowing him to lose himself in a labyrinth of data and argument. By the time he has read the final chapter and finds himself encountering the four-part Appendix he will be interested in the simple explanation of soil classification and maps, and in the tabular arrangement of the characteristics of the Great Soil Groups and the landscapes over the earth's surface with which they are associated.

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[1] Prepared solely for use by the Soil Conservation Service and official cooperators. Not available for general distribution.

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DETROIT

Reducing Highway Maintenance Costs Through Farm Land Conservation

By GEORGE C. MOORE[1]

Soil conservation in the Northeast is primarily a problem of surface water control. Disposal of the excess water frequently confronts landowners as a major problem, and highway officials are equally concerned. Until recently landowners and highway officials did not make joint plans for handling that water—it remained public enemy No. 1 to all classes of roads, forcing highway maintenance costs up to the level of the largest items in townships' annual budgets. In the past, a few legislative statutes, many court decisions, and long-established customs have governed surface water rights in New York State. In general, this lack of attention to an (Continued inside on p. 166)

[1] Area soil conservationist, Northeastern Region, Soil Conservation Service, Ithaca, N. Y.